

**THREE NEW SPECIES OF CHEWING LICE (PHTHIRAPTERA:
ISCHNOCERA: PHILOPTERIDAE) FROM AUSTRALIAN PARROTS
(PSITTACIFORMES: PSITTACIDAE)**

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Abstract.—Three new Australian philopterid chewing louse species from parrots are described and illustrated. They and their type hosts are *Neopsittaconirmus vicesmithi* from Bourke's parrot, *Neopsephotus bourkii* (Gould), from Western Australia and *Neopsittaconirmus bushae* and *Echinophiloaterus claytoni*, both from the Bluebonnet, *Northiella haematogaster* (Gould), from New South Wales. A portion of the mitochondrial COI gene was sequenced for these species and other parrot lice to evaluate their genetic distinctiveness.

Key Words: chewing lice, *Neopsittaconirmus*, *Echinophiloaterus*, Phthiraptera, Philopteridae, parrots, Australia

The chewing louse philopterid genus *Neopsittaconirmus* Conci has been thoroughly treated by Guimarães (1974), with two subsequent works by Price and Emerson (1978, 1985) having expanded slightly on his findings. The checklist of Price *et al.* (2003) recognizes 30 species from this genus, all restricted to 40 species of parrots. A second genus, *Echinophiloaterus* Ewing, is smaller regarding the number of included species, with only eight recognized by Price *et al.* (2003) from 25 species of parrots and one from a species of coraciiform host. This genus, as with *Neopsittaconirmus*, also has received a comprehensive treatment by Guimarães (1980). As a result of recent collecting of chewing lice in Australia by the junior author and his colleagues, we have obtained three series of lice from parrots, each representing a new species: two of *Neopsittaconirmus* and one of *Echinophiloaterus*. It is our

purpose to describe and illustrate them herein. For these species and other parrot lice, we sequenced a portion (379 base pairs) of the mitochondrial cytochrome oxidase I (COI) gene to evaluate the genetic distinctiveness of these species.

For the following descriptions, all measurements were made with an ocular micrometer and are given in millimeters. All lice used in this study were slide-mounted in Canada balsam following the procedure given in Price *et al.* (2003: 8). Abbreviations for dimensions are: TW, temple width; HL, head length at midline; PW, prothorax width; MW, metathorax width; AWV, abdomen width at segment V; TL, total length; and GL, male genitalia length. Host classification below that of order follows Dickinson (2003). Holotypes are deposited in the insect collection of the Illinois Natural History Survey, Champaign;

paratypes are deposited there and in the collection of The Field Museum, Chicago, Illinois.

Genus *Neopsittaconirmus* Conci

Neopsittaconirmus Conci 1942: 37. Type species: *Neopsittaconirmus borgioli* Conci, by original designation.

The members of this genus are elongate slender lice with head evenly rounded anteriorly (Fig. 1); preantennal region with pair of circular dark guttate sclerotizations; temple only slightly wider than preantennal portion; antennae with or without sexual dimorphism. Pronotum with single short seta near each lateroposterior corner; metanotal margin with 4 long to very long setae on each side. All abdominal tergites complete for both sexes, with possible exception of tergite I; without anterior tergal or sternal setae. Sternites usually weakly developed. Female subgenital plate with posterior margin having number of short spiniform setae. Male genitalia with prominent projecting parameres and variable complex of medioposterior structures.

Neopsittaconirmus vicesmithi Price and Johnson, new species

(Figs. 1–5)

Type host.—*Neopsephotus bourkii* (Gould), the Bourke's parrot.

Male.—As in Fig. 1. Very long median pair of tergal setae on II–VIII; extremely long tergolateral seta on III–VII; with shorter such seta on VIII. Median pair of sternal setae on II–VII. Lateral margin of abdomen with no setae on II–IV, single very long seta on V–VII, and very long and shorter setae on VIII–IX. Posterior chaetotaxy as in Fig. 1. Genitalia as in Fig. 2; parameres slender, gently rounded, with slight incurving; median structures with detail as in Fig. 3. Dimensions: TW, 0.27–0.28; HL,

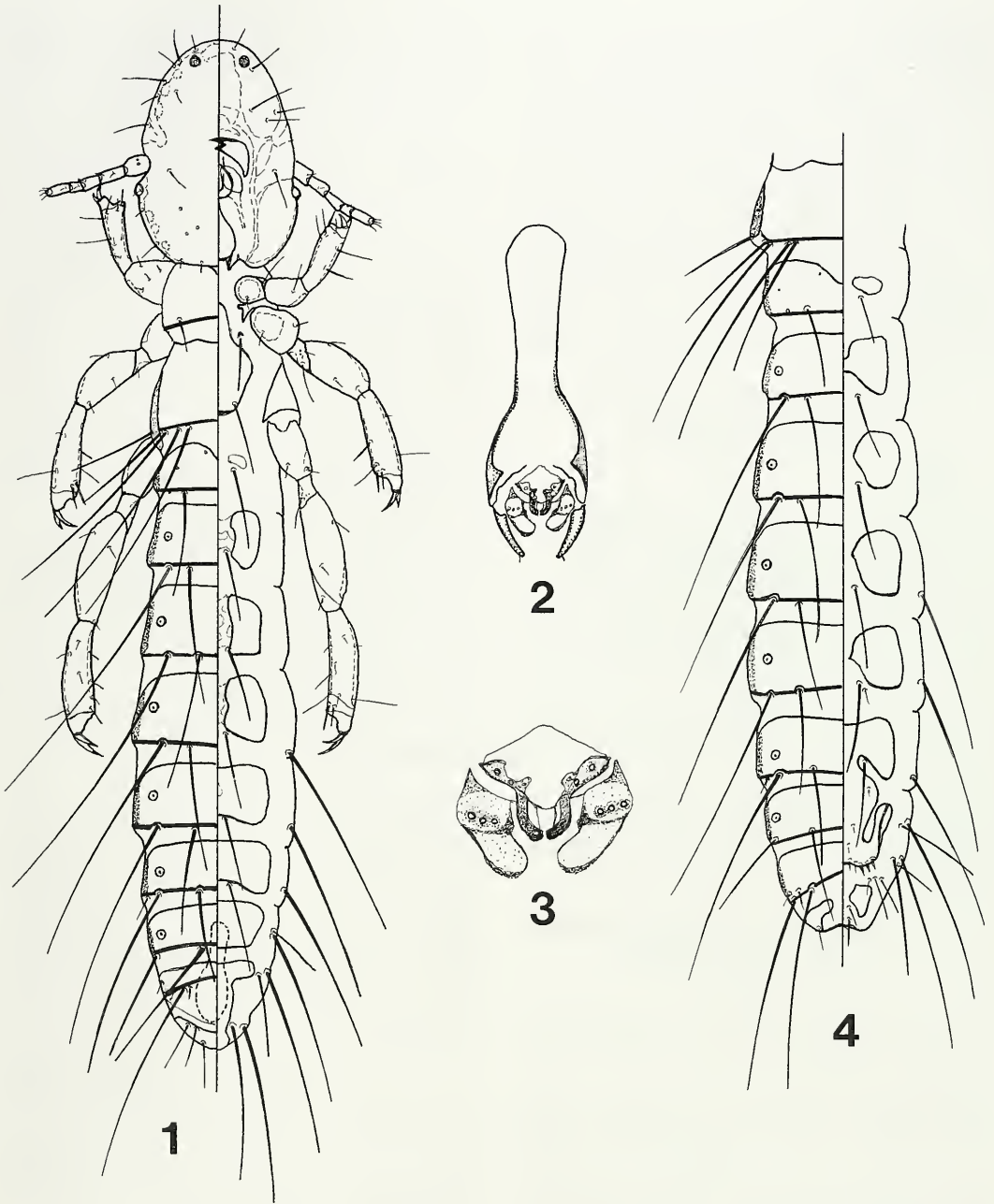
0.36–0.39; PW, 0.16–0.18; MW, 0.24–0.28; AWV, 0.27–0.29; TL, 1.53–1.70; GL, 0.15–0.16.

Female.—Metanotum and dorsoventral abdomen as in Fig. 4. Chaetotaxy much as for male, except for details associated with posteriormost segments. Ventral subgenital plate as in Fig. 5, with posterior margin of plate essentially transverse, bearing 4–5 short spiniform setae on each side with 4–6 fine short setae centrally between them and an occasional such seta inserted within row of spiniforms; broad bridge connecting sternite VII with sternal plate on VIII; lateral margins of sternite VII strongly defined. Dimensions: TW, 0.31–0.32; HL, 0.41–0.44; PW, 0.20–0.21; MW, 0.28–0.34; AWV, 0.26–0.32; TL, 1.76–1.94.

Type material.—Holotype ♀, ex *Neopsephotus bourkii*, Australia: Western Australia, 90 km N of Kumarina Roadhouse, N of Mekkatharra, 7 May 2002, T. Chesser, ANWC (=Australian National Wildlife Collection) 33003. Paratypes: Ex *N. bourkii*, 3 ♂, 1 ♀, same data as holotype; 1 ♂, 1 ♀, same except 12 km N of Overland Roadhouse, S of Carnarvon, 22 May 2002, ANWC 33374.

Other material.—1 ♀, ex *Psephotus haematonotus* (Gould), Australia: New South Wales, E Mount Hope, 24 July 2001, K. P. Johnson, ANWC 29297.

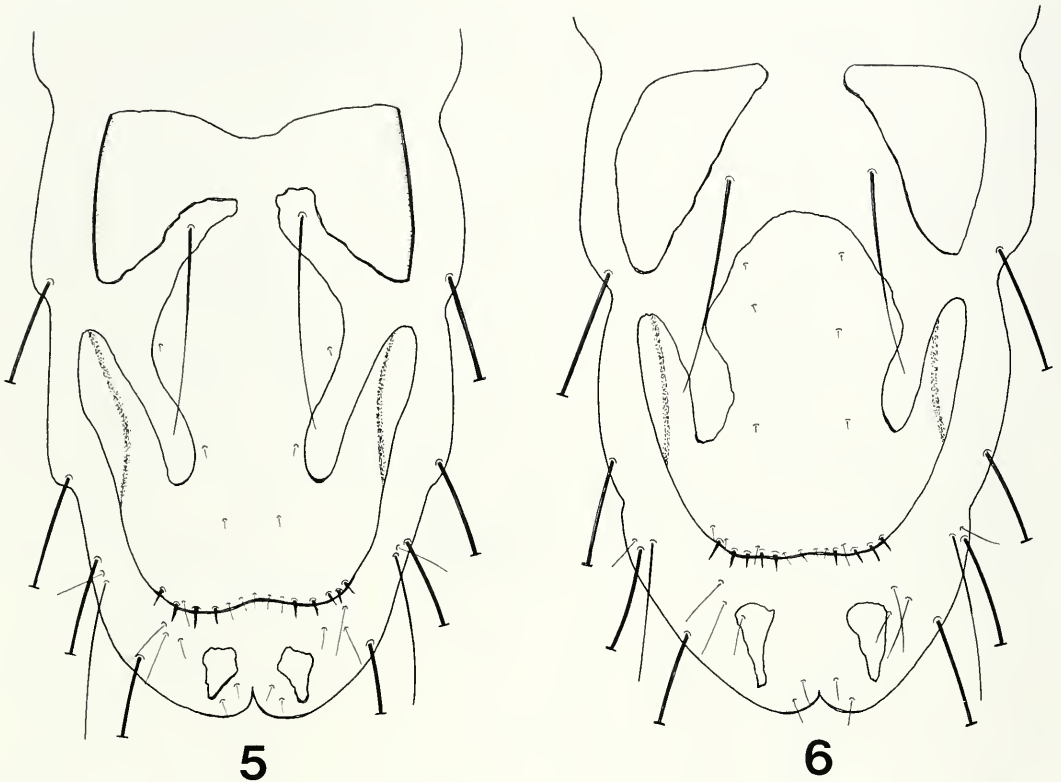
Remarks.—This new species is readily separable from all other described species in the genus by the female subgenital plate having a predominantly transverse posterior margin (Fig. 5); the posterior portion of the plates of the other species is typically a broad "V"- or "W"-shape. The male is distinctive by its alignment and shape of the parameres (Fig. 2) and the details of the median genitalic features (Fig. 3); most other species have outwardly-curved or straight parameres of a quite different shape. Only *N. anodis* (Neumann) and *N. abnormis* Guimarães have parameres approaching the type for



Figs. 1-4. *Neopsittaconirnus vincesmithi*. 1, Dorsoventral entire male. 2, Male genitalia. 3, Male medioposterior genitalic details. 4, Female metanotum and dorsoventral abdomen.

N. vincesmithi, but both sexes of these differ profoundly by a number of other features. The chaetotaxy of the abdominal tergites will also support separation of this species from others.

Etymology.—*Neopsittaconirnus vincesmithi* is named for our colleague Vincent S. Smith, The Natural History Museum, London, in recognition of numerous contributions to understand-



Figs. 5-6. Ventral female terminalia. 5, *Neopsittaconirmus vincesmithi*. 6, *N. bushae*.

ing the systematics of lice and to the electronic infrastructure for louse taxonomic data.

***Neopsittaconirmus bushae* Price and Johnson, new species**

(Fig. 6)

Type host.—*Northiella haematogaster* (Gould), the Bluebonnet.

Male.—Much as in Fig. 1, apparently inseparable from *N. vincesmithi* except for tendency for *N. bushae* to have larger dimensions. Dimensions: TW, 0.30–0.33; HL, 0.41–0.45; PW, 0.20–0.22; MW, 0.28–0.33; AWV, 0.31–0.36; TL, 1.68–1.95; GL, 0.16–0.18.

Female.—Likewise very close to *N. vincesmithi*, with metanotum and dorso-ventral abdomen much as in Fig. 4. However, details of subgenital plate as in Fig. 6, with posterior margin of plate essentially transverse, bearing 4–5 short

spiniform setae on each side with interspersed fine short setae; sternite VII with distinct separation from sternal plate on VIII and without strongly defined lateral margins. Dimensions: TW, 0.31–0.36; HL, 0.41–0.47; PW, 0.21–0.24; MW, 0.33–0.36; AWV, 0.27–0.37; TL, 1.84–2.12.

Type material.—Holotype ♀, ex *Northiella haematogaster*, Australia: New South Wales, E Mount Hope, 24 July 2001, K. P. Johnson, ANWC 29300. Paratypes: 2 ♀, 3 ♂, same data as holotype.

Other material.—3 ♀, 2 ♂, ex *Psephotus varius* Clark, Australia: South Australia, Pootnoura Creek, 1 May 2002, T. Chesser, ANWC 32736 and ANWC 32737.

Remarks.—Both sexes of *N. bushae* are separable from all previously described species of this genus by the same

features as given for *N. vincemithi*. While *N. bushae* is admittedly quite close morphologically to *N. vincemithi*, the well defined differences associated with the female subgenital plate (Fig. 6 vs. Fig. 5) and the generally larger dimensions of both sexes of the former will afford separation.

Neumann (1890: 65) described "*Li-peurus forficuloides*" from a host now known as *Psephotus varius*. Guimarães (1974) commented on the status of this species, currently recognized as *Psittaconirmus forficuloides* (Neumann), concluding that it must be referred to as a "*species inquirenda*". The description of *P. forficuloides* is clearly that of a *Psittaconirmus* louse, but little can be said beyond that, as opposed to the distinctly different genus *Neopsittaconirmus*. Guimarães (1974) believed the host association was in error and the type specimens in Neumann's collection at Toulouse had been lost, thus making positive identification of this species impossible. We concur with that action, citing this here so as to avoid any confusion between the Neumann *Psittaconirmus* name and our inclusion of *P. varius* lice as *Neopsittaconirmus bushae*.

Etymology.—*Neopsittaconirmus bushae* is named for our colleague Sarah E. Bush, The Natural History Museum, University of Kansas, Lawrence, in recognition of her numerous contributions to understanding the ecology of avian chewing lice.

Genus *Echinophlopterus* Ewing

Echinophlopterus Ewing 1927: 92. Type species: *Echinophlopterus chapini* Ewing, by original designation.

The members of this genus are broad lice with head usually markedly narrowed anteriorly; medioanterior margin with forceps-like modification (Fig. 9); distinctly widest across temples; well-defined dorsoanterior plate present; antennae without sexual dimorphism. Pronotum

with single short seta at each lateroposterior corner; each side of metanotal margin with variable number of long setae. Abdomen broad, with tergites I–VII having wide median separation for both sexes; without anterior tergal or sternal setae. Sternites usually reduced. Ventral surface of abdomen often with prominent patch of spiniform setae on anterior three segments. Male genitalia with prominent parameres and variable complex of medioposterior structures.

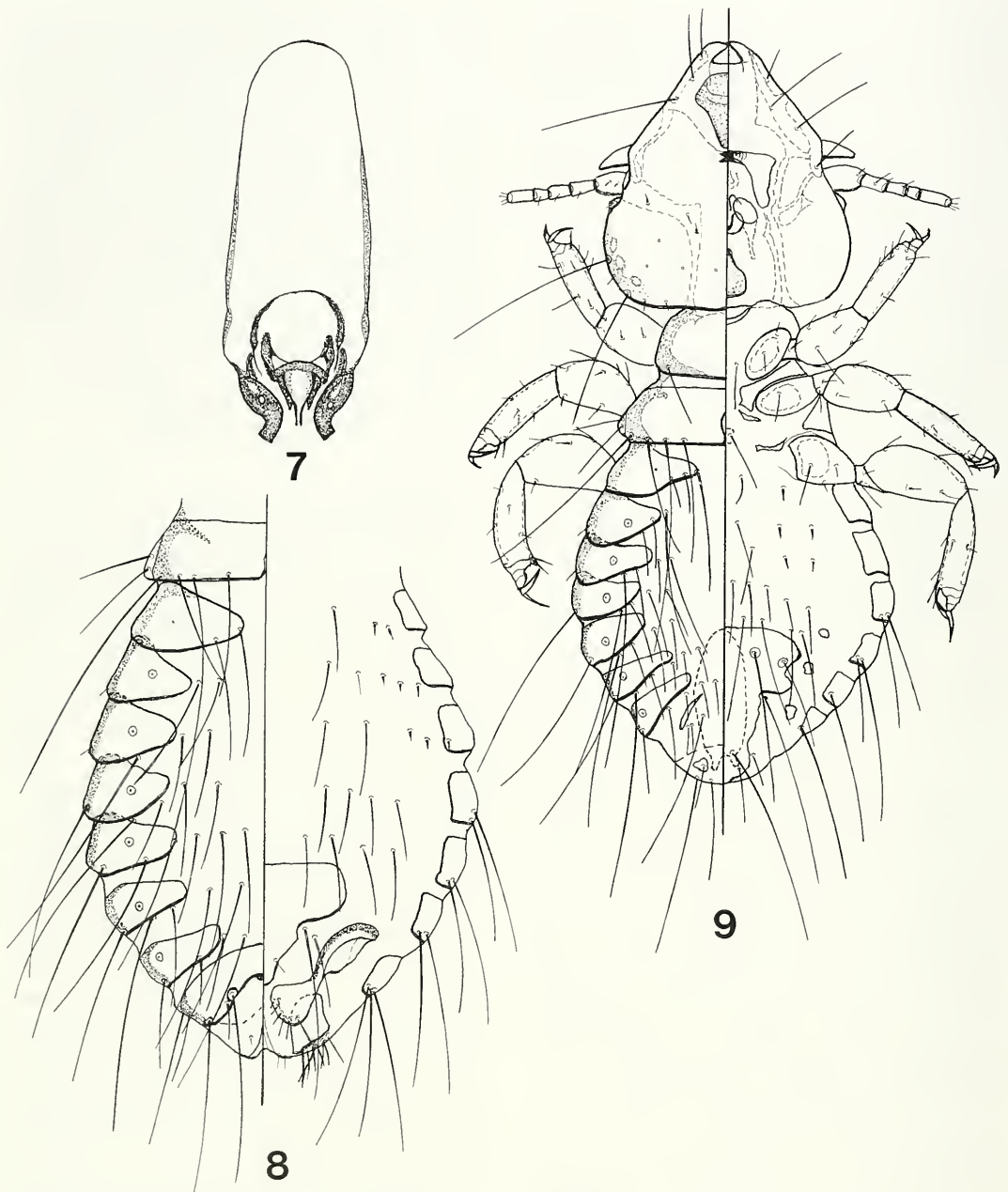
Echinophlopterus claytoni Price and Johnson, new species

(Figs. 7–9)

Type host.—*Northiella haematogaster* (Gould), the Bluebonnet.

Male.—As in Fig. 9. Preantennal portion of head with straight converging margins. Metanotal margin with 4 long setae on each side. Each tergum II–VI with total of 6–8 setae positioned between spiracles; VII–VIII with 9–11 such setae; tergite IX weakly developed. Sterna II–IV with median pair of setae accompanied by several short lateral spiniform setae; sterna on V to end of abdomen as shown in Fig. 9. Lateral margin of abdomen with no setae on II, very short seta on III–IV, very long seta on V–VII, and shorter seta on VIII. Genitalia as in Fig. 7; parameres stout, recurved, with truncated posterior margin; median structures with detail as in Fig. 7. Dimensions: TW, 0.42; HL, 0.39 (from anterior margin of dorsoanterior plate); PW, 0.24; MW, 0.36; AWV, 0.54; TL, 1.16; GL, 0.22.

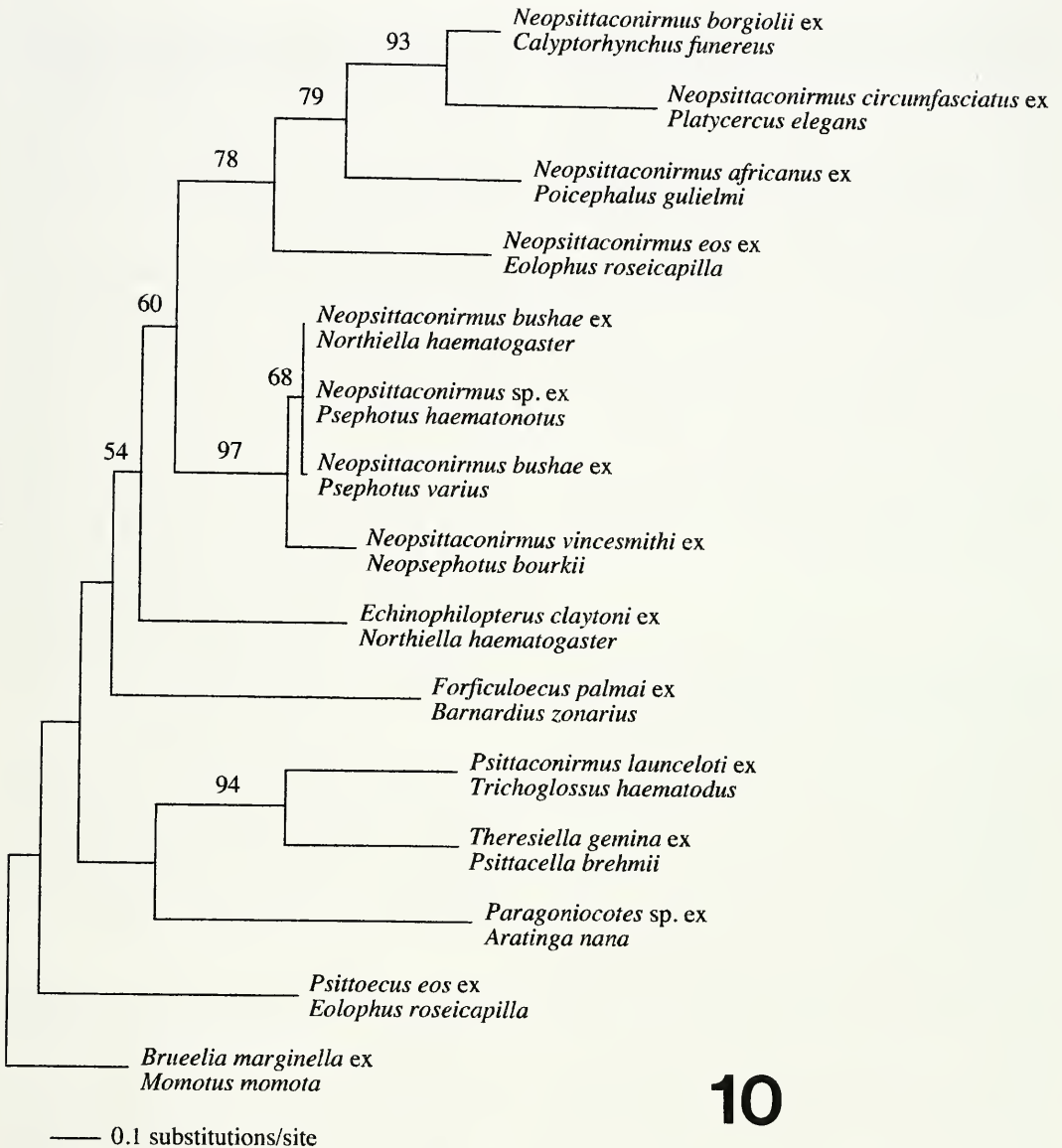
Female.—Metanotum and dorsoventral abdomen as in Fig. 8. Chaetotaxy of abdomen much as for male, except for details associated with posteriormost segments; tergite IX complete across abdomen, with very long marginal setae as shown. Dimensions: TW, 0.48; HL, 0.45 (from anterior margin of dorsoanterior plate); PW, 0.28; MW, 0.43; AWV, 0.66; TL, 1.45.



Figs. 7-9. *Echinophlopterus claytoni*. 7, Male genitalia. 8, Female metanotum and dorsoventral abdomen. 9, Dorsoventral entire male.

Type material.—Holotype ♂, ex *Nor-thiella haematogaster*, Australia: New South Wales, E Mount Hope, 24 July 2001, K. P. Johnson, ANWC 29301. Paratype: 1 ♀, same data as holotype.

Remarks.—This species is readily recognized from all other known species of *Echinophlopterus* by the unique shape of the head with its broadly tapered pre-antennal portion, by the structure of the



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Fig. 10. Phylogenetic tree of parrot louse genera (Ischnocera) based on maximum likelihood (ML) analyses of partial mitochondrial COI sequences. Numbers above branches are support from 100 ML bootstrap replicates. Branch lengths proportional to substitutions per site (scale indicated). Tree rooted on *Brueelia marginella*, a parasite of a motmot.

male genitalia, especially the distally truncated parameres, and by the absence of a dense patch of short spiniform setae on the first three abdominal sterna.

Of the described species of *Echinophlopterus*, the head shape and lack of spiniform setae on the anterior abdominal sternal area for *E. bupthalmus* (Piaget)

are reminiscent of *E. claytoni*. However, *E. bupthalmus* has markedly different male genitalia with elongate tapered parameres and the ventral female terminalia with a quite different chaetotaxy. The only non-psittaciform louse of this genus, *E. inexpectatus* Guimarães, whose type host is the long-tailed ground roller,

Uratelornis chimaera Rothschild (Coraiciiformes: Brachypteraciidae), has similar male genitalia and female ventral terminalia as for *E. claytoni*. However, the much smaller dimensions, the broader anterior head, and the denser abdominal chaetotaxy easily characterize *E. claytoni*. Both of these "near" relatives of *E. claytoni* are African, whereas *E. claytoni* is Australian.

Etymology.—*Echinophlopterus claytoni* is named for our colleague Dale H. Clayton, Department of Biology, University of Utah, Salt Lake City, in recognition of his numerous contributions to understanding the ecology of avian chewing lice and of his taxonomic work on parrot lice.

DISCUSSION

Sequences from the mitochondrial COI gene (GenBank Accession numbers EF058159–62) generally support the taxonomic conclusions of this paper. *Neopsittaconirmus vinctusmithi* and *N. bushae* are indeed very closely related species, and separated from other species of *Neopsittaconirmus* (Fig. 10). However, these two species are 10% divergent from each other, on par with other divergences between closely related louse species (Johnson and Price 2006). Divergence between *N. bushae* from *Northiella haematogaster* and *Psephotus varius* was 0.5%, consistent with other reported within-species divergences. However, one surprising result was that the sequence of *Neopsittaconirmus* from *Psephotus haematonotus* was identical to that of *N. bushae* from *Northiella haematogaster*, the type host. Unfortunately the individual sequenced from *P. haematonotus* was a nymph so a firm morphological identification could not be made. Further collecting is needed to determine whether this represents dual infestation of this host species by multiple *Neopsittaconirmus* species, or is a case of contamination, or highlights the difficulty in distinguishing *N. bushae* from *N. vinctusmithi*. Only one

adult from *Psephotus haematonotus* was available for study and this individual was not sequenced. Only the present species of *Echinophlopterus* was available for sequencing, so no comment can be made on its genetic distinctiveness from other species of this genus.

Phylogenetic analysis of the COI sequences supports the monophyly of *Neopsittaconirmus* as distinct from other genera of parrot lice (Fig. 10), and this is supported by bootstrapping (60%). Other species of this genus also show pronounced genetic divergences from each other (ranging from 17% to 23%). *Theresiella* is strongly supported as the sister to *Psittaconirmus*, and *Echinophlopterus* may be sister to *Neopsittaconirmus*, though weakly supported (bootstrap 54%). More work is needed to determine the relationships among the other parrot louse genera.

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